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FILLING HEAD FOR VACUUM POWDER FILLING MACHINES

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Fig. 1.

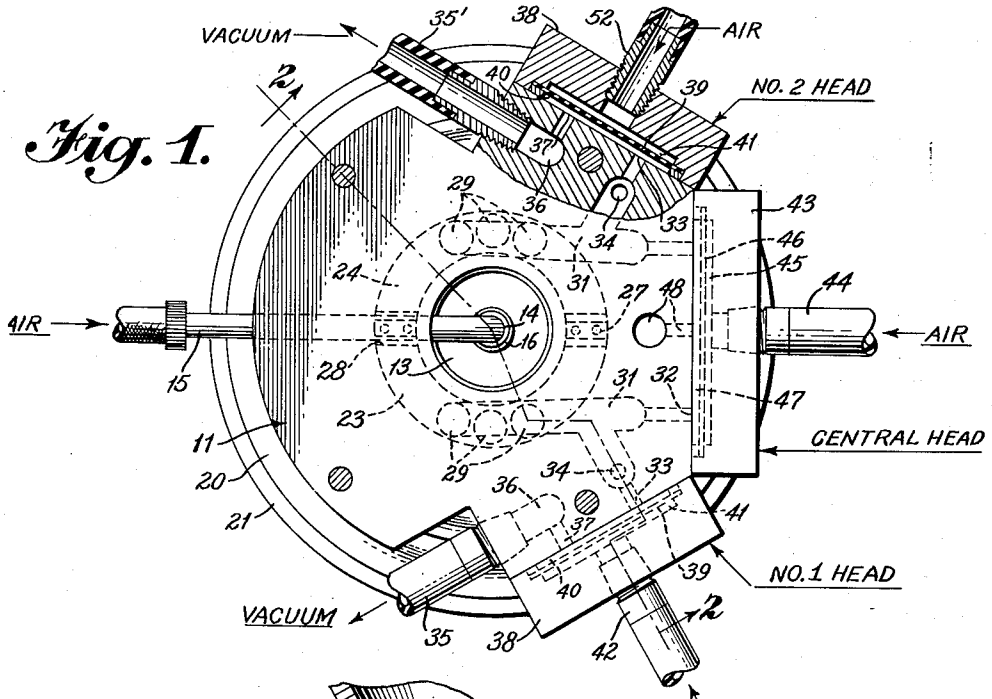
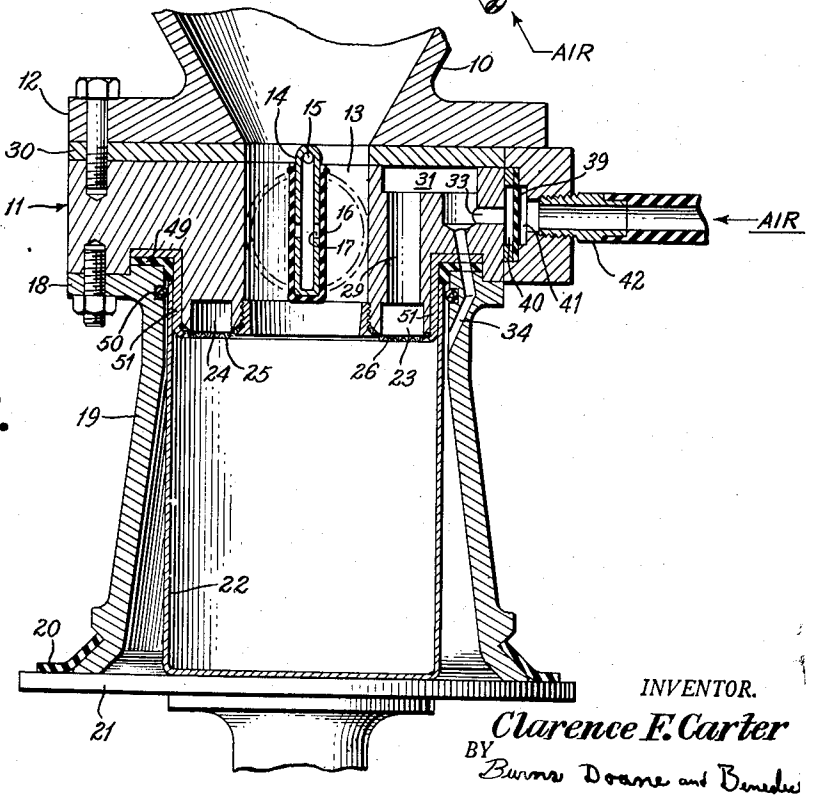


Fig. 2.



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FILLING HEAD FOR VACUUM POWDER FILLING MACHINES

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5 Claims. (Cl. 226—116)

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This invention relates to a vacuum filling head and shroud useful for filling containers, particularly flexible or non-rigid containers such as bags, cardboard boxes, and the like, with powders.

The filling head of this invention may be used in connection with vacuum filling machines of the type described in my U. S. Patents Nos. 2,170,469 and 2,443,182, and application S. N. 593 filed January 5, 1948, now Patent No. 2,613,864, issued October 14, 1952.

It is an object of the invention to provide a compact filling head and shroud for use particularly in connection with multiple head powder filling machines wherein the rate of filling may be of the order of several hundred containers per hour.

Figure 1 is a plan view in partial section of the filling head; and

Figure 2 is a sectional elevation of the head and shroud taken along the line 2—2.

10 is a hopper which may be of the rotary type disclosed in U. S. Patent No. 2,443,182. The filling head proper is generally designated as 11. The hopper 10 is attached to filling head 11 by means of flange 12, a plate 30 lying therebetween. Through the center of the body 11 is a powder passageway 13 in which may be disposed a valve of the type disclosed in my copending application Serial No. 271,748, filed February 15, 1952. The valve comprises a vertical tube 14 centrally located in the annular space 13. The tube 14 is supported on a line 15 which extends outwardly through the body of the filling head and may be connected to a source of air pressure and a source of vacuum. Thus the line 15 may be termed a vacuum-air line. The line may be attached to a three-way valve, one inlet of which is attached to a source of air pressure and the other to a source of vacuum, or the line may lead to an oscillating valve of the type shown in my copending application, for an oscillating valve mechanism, filed concurrently herewith. Around the tube 14 is an inflatable rubber tube 16. This is attached at either end. There are perforations 17 in tube 14 and tube 16 lies over these. When air pressure is applied through line 15 the tube 16 is inflated to the position shown by the dotted lines, thus effectively closing the passage 13.

Attached by means of flange 18 to the filling head 11 is a shroud 19 which may have a rubber skirt 20 intended to coact with a platform 21 to seal the bottom of the shroud. This platform is pneumatically operated by means of an air cylinder or other suitable means for raising a container 22 into filling position and lowering it out of the shroud when the filling operation is completed.

Adjacent the passageway 13 are annular grooves or kerfs 23 and 24 over which are secured screens 25 and 26. These annular grooves are divided from each other at 27 and 28. This structure is similar to that shown in my U. S.

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Patent No. 2,170,469. The structure associated with the annular kerf 23 will be hereinafter referred to as head No. 1 and that associated with kerf 24 will be referred to as head No. 2, as may be seen in Figure 1.

Extending into the kerf 23 is a series of vertical passageways 29. Similar passageways open into kerf 24. The vertical passageways 29 are branches of horizontal main passageway 31, this passageway being closed at the top by plate 30. Relief port 32 opens into main passageway 31, as does vacuum port 33. A second branch passageway 34 leads downwardly into the interior of the shroud, externally of the container. Extending into the filling head is line 35 (or 35') which opens into passageway 36 and vacuum supply port 37. A valve block 38 is secured to the filling head 11. In the valve block is a rectangular recess lying over ports 33 and 37. The recess is divided longitudinally by an inflatable diaphragm 39 of rubber or other suitable material. This forms a rectangular passageway 40 into which ports 33 and 37 open and a chamber 41 into which air-vacuum lines 42 and 52 open. When air pressure is applied to line 42 (or 52), diaphragm 39 inflates into the passageway 40 and covers ports 33 and 37, thus preventing vacuum from being drawn through head No. 1 by way of line 35 (or head No. 2 by way of line 35'). When vacuum is applied to line 42 (or 52), diaphragm 39 is pulled away from ports 33 and 37 so that a continuous passageway is formed from line 35 through port 37, port 33 and passageways 29, 31 and 34, thus simultaneously evacuating the interior of container 22 and the space in the shroud surrounding container 22. Thus when the valve in passageway 13 is open, powder is withdrawn from hopper 10 into the container. Since the pressure inside and outside of the container is equal, the container cannot burst even though it be a paper bag, cardboard box or the like.

The construction and operation of head No. 2 is identical with that of head No. 1.

A block 43 is attached to the body of the filling head 11 and is of similar construction to the control valves of filling heads Nos. 1 and 2. An air-vacuum line 44 leads into a recess 45 in block 43. The recess is divided longitudinally by a rubber diaphragm 46 leaving a passageway 47 between the diaphragm and the body 11 of the head. Leading from the passageway 47 is an exit port 48 which opens to the atmosphere. Thus when air pressure is applied to diaphragm 46 through line 44 it closes relief port 32 and exit port 48 and cuts off communication of the atmosphere with the interior of the container and shroud. When vacuum is drawn through line 44, diaphragm 46 is pulled away from ports 32 and 48 and there is communication of the interior of the shroud and the container with the atmosphere.

The operation of the filling head during the filling operation is similar to that disclosed in my U. S. Patent No. 2,170,469. The operation may be summarized as follows:

At the beginning of the filling operation the platform 21 has been lowered away from the shroud and a container is placed theron. The platform 21 is then raised, putting the container 22 into filling position and sealing it within the shroud. If the container is rigid, or relatively so, it may thrust against the rubber gasket 49 to form a seal which prevents communication between the interior of the container and the shroud around it. This seal may be further improved by inflating an inflatable member 50 which lies in the upper part of the shroud and when inflated thrusts the wall of the container against that portion of the filling head (designated as 51) which extends downwardly into the open top of the container. This structure is not shown in detail but may correspond to that shown in my U. S. Patent No. 2,513,143. Modification of the present filling head to embody the features disclosed in said patent will be readily apparent to one skilled in the art. The one advantage of this type of sealing mechanism is to hold a container in place firmly and prevent powder from the container being drawn into the shroud surrounding it. Since the container is held in position at a point below the open top, it prevents the container from being split. This is particularly important in connection with paper bags.

Up to the point described, air pressure is applied through line 42 of filling head No. 1 and line 52 of filling head No. 2, thus thrusting the diaphragm 39 over the ports 33 and 37 and cutting off the vacuum which would otherwise be drawn through the two halves of the filling head. Vacuum is drawn through line 44, pulling diaphragm 46 away from ports 32 and 48 so that continuous open passageways lead from the interior of the container and of the shroud to the atmosphere. At this time the passageway 13 is closed by applying air to line 15 and inflating the rubber tube 16 into the position shown in the dotted lines so that no powder can fall through the passageway.

When the filling operation begins air pressure is applied to line 44, thus closing off ports 32 and 48. A vacuum is drawn on lines 42 and 52, thus opening ports 37 and 33 so that vacuum is drawn through lines 35 and 35', evacuating the interior of the container and of the shroud to the same pressure as heretofore explained. The valve in passageway 13 is now deflated by applying vacuum to line 15. The vacuum existing within container 22 causes powder to flow from hopper 10 into the container. The major part of the filling occurs at this stage. Air pressure may then be applied to lines 42 and 52, closing ports 33 and 37. A vacuum is applied to line 44, opening ports 32 and 48. The air from the atmosphere rushes back through passageway 47 and ports 32 to the interior of the container and of the shroud. The air drawn through screens 25 and 26 dislodges particles of powder that may have accumulated there during the initial filling operation.

The central head valve (relief valve) is then closed by applying air pressure to line 44. Air pressure is still applied to line 52, thus effectively closing head No. 2. Head No. 1 is opened by applying vacuum to line 42, the valve in passageway 13 remaining open. This causes additional powder to be drawn from hopper 10 into the container. Head No. 1 is then closed and the central head valve is opened, thus restoring the interior of the container and shroud to atmospheric pressure. The central head valve is then closed, head No. 1 remaining closed and head No. 2 is opened by applying vacuum to line 52. This again evacuates the interior of the container and the shroud, causing additional powder to flow into the container. This operation may be repeated several times. It has the advantage of not only making certain that the container is completely filled with powder, but it exerts a vibrating effect on the contents of the container, causing it to be de-aerated and to pack down into the container so that the contents will not settle after the package is sealed. Such an oscillating action has been described in my above-mentioned U. S. patents. A mechanism for producing this oscillating effect is described in Patent No. 2,538,441.

The invention is not limited to the exact structure of the embodiment illustrated.

I claim as my invention:

1. An apparatus of the character described, comprising a filling head body, means for attaching the body to a hopper, a shroud mounted on the body, a powder passageway from the hopper to a container when in filling position, said apparatus including a vacuum-relief system comprising; a main gas passageway in said body, a first branch passageway connecting the main passageway with the interior of a container when in filling position, a second branch passageway connecting the main passageway with the interior of the shroud external of the container, an atmospheric relief port opening from the main passageway, a vacuum port opening from said main passageway, a vacuum supply port in the body adjacent the vacuum port, means for connecting the vacuum supply port with a source of vacuum, a valve block mounted on the head covering the vacuum and vacuum supply ports, an inflatable diaphragm in the valve block, and means to inflate and deflate the diaphragm to control the vacuum and vacuum supply ports; and a relief valve to control said relief port.

2. The apparatus of claim 1 further characterized in having an inflatable valve positioned in the powder passageway, and means attachable to a source of air pressure and a source of vacuum for inflating and deflating said valve.

3. The apparatus of claim 1 further characterized in having a screened kerf in the body adjacent the powder passageway, said first branch passageway opening into said kerf.

4. The apparatus of claim 1 comprising an exit port in the body leading to the atmosphere, said relief valve comprising a block mounted on the body over the relief port and the exit port, an inflatable diaphragm in said block, and means for inflating and deflating the diaphragm to control the relief and exit ports.

5. The apparatus of claim 1 comprising a first screened kerf extending part way around the powder passageway, the first branch passageway opening into the kerf, a second screen kerf extending part way around said powder passageway but divided from the first kerf, a second vacuum-relief system in the head duplicating that first described, and associated identically with the second kerf, an exit port to the atmosphere adjacent the relief ports, said relief valve comprising a block mounted on the body over the relief ports and the exit port, an inflatable diaphragm in the block, and means for inflating and deflating the diaphragm to control said exit port and relief ports.

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No references cited.